

# *pacific* **ENSO** *update*

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**A Quarterly Bulletin of the Pacific El Niño/Southern Oscillation Applications Center (PEAC)  
Providing Information on Climate Variability for the U.S.-Affiliated Pacific Islands**

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## CURRENT CONDITIONS

**El Niño conditions persist in the Pacific and are expected to continue for the next 3 to 6 months.** El Niño is anticipated to weaken during this time, as the Southern Oscillation Index and NIÑO 3.4 sea surface temperatures are thought to have reached their peak in December.

For all of 2006, the rainfall throughout Micronesia was near normal ( $\pm 20\%$ ) at most locations (**Fig. 1**), with few extreme events of rainfall and no destructive typhoons experienced at any island. The anticipated eastward shift of tropical cyclone activity in the fall of 2006 did not materialize. Instead, several typhoons formed to the west of Guam and had enormous impacts to the Philippines. This was more akin to the typical behavior of typhoons during La Niña events than during El Niño.

Based on the anticipated slow demise of El Niño during the first half of 2007, tropical cyclone activity is expected to be below normal throughout Micronesia during this time period. **In American Samoa, however, the risk of a tropical cyclone is enhanced, with two or three named cyclones expected to form near the islands during January - April.** American Samoa is expected to be very wet through April of 2007, with a high risk of at least gale-force winds related to the close passage of a tropical cyclone or the penetration of a very active north-west monsoon into the region.

**Below normal rainfall is anticipated throughout most of Micronesia and Hawaii for the next six months. Island residents are urged to participate in voluntary water conservation measures, and to undertake low-cost repairs and maintenance of the means of obtaining drinking water.** If extreme dry conditions develop in the next 3 to 6 months, a more serious effort may be required to ensure adequate water supplies for all islanders. **Most islands are expected to receive 60% to 70% of the rainfall normally expected during the first six months of 2007.** However, month-to-month variations in rainfall patterns (which are unpredictable) may cause any island to experience less than half of normal rainfall during any one or two of the months from January through June of 2007. By comparison, many locations received considerably less than half of normal rainfall for ALL of the months during the first half of 1998! The risk of wildfires will be high beginning in late January through June on islands that typically experience them at this time of year. Residents are urged to clear away brush and

loose combustible materials located near their homes.

The sea-level variation in the northwestern tropical Pacific islands has been identified to be sensitive to the ENSO-cycle, with low sea-levels during El Niño and high sea-levels during La Niña events. Despite the mature El Niño conditions, however, the sea level has not yet recorded any considerable fall this year. This could be due to the evaluation pattern of this year's El Niño, the onset of which is relatively late (September 2006). Therefore, considerable sea level drop is yet to be seen—and will most likely be visible in the months to come.

Many Micronesian islands typically enter their dry season at the start of the calendar year. For islands north of 10° N, the normal dry season may persist through June or July. For islands that are along the ITCZ rainfall maximum (such as Pohnpei, Kosrae, and the southern Marshalls, the normal dry season is typically experienced as one or two moderately dry (10-inch) months occurring anytime within January - March. El Niño-related dry conditions manifest throughout Micronesia as below-normal rainfall during the typical dry season months, and as an extension of the length of the dry season in both directions (e.g., earlier than normal dry season onset, and a later than normal end to the dry season.) The effects of ENSO on the rainfall in American Samoa are somewhat less defined than in Micronesia, with a tendency for dry conditions to be experienced only after a strong El Niño, and wet conditions experienced during some weak and moderate El Niño events.

The following comments from the EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION were posted on the U.S. Climate Prediction Center web site on January 11, 2007:

***"Synopsis: El Niño conditions are likely to continue through March-May 2007."***

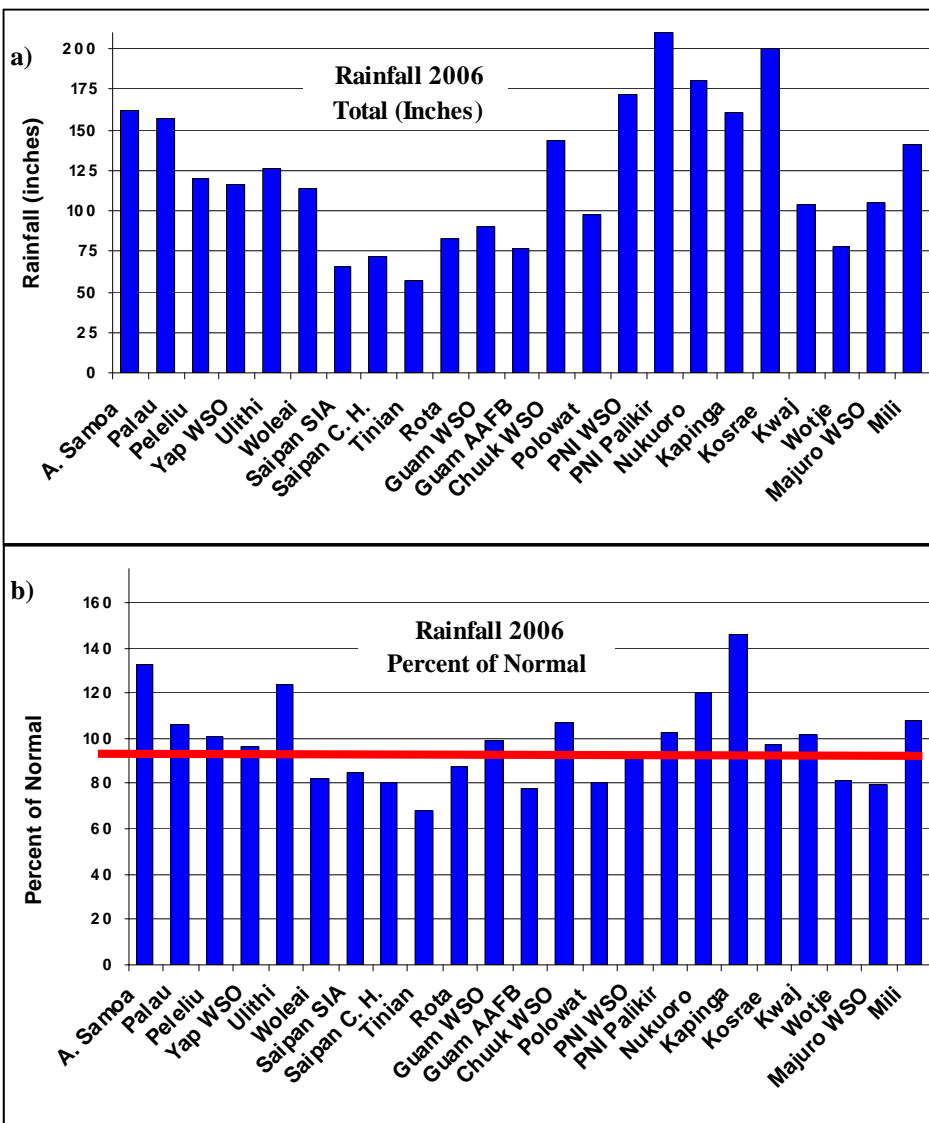
*"...Most of the statistical and coupled models... indicate that SST anomalies are near their peak and that decreasing anomalies are likely during February-May 2007. Recent observed trends in the upper ocean tend to support those forecasts. ..."*

*"Global effects that can be expected during January-March include drier-than-average conditions over portions of Malaysia, Indonesia, northern and eastern Australia, some of the U.S.-affiliated islands in the tropical North Pacific ..."*

## CURRENT CONDITIONS

SST (Sea Surface Temperatures)

By the end of September 2006, the waters of the equatorial Pacific had sufficiently warmed to meet NOAA's definition of El Niño. From mid-September to mid-December, ocean surface temperatures remained greater than 0.5°C above average across the equatorial Pacific between 155°E and the South American coast, with departures exceeding +1°C between 165°E and 145°E and also between 85°W and 125°W. After peaking in mid-December, SST anomalies have begun to decrease in all Niño regions. The latest ocean surface temperature anomalies remain between +0.9°C and +1.1°C in all of the Niño regions except the Niño 1+2 region (+0.5°C), indicating weak-to-moderate El Niño conditions. During November - December 2006, positive subsurface temperature anomalies were observed throughout the equatorial Pacific. Since early October, upper ocean heat content has been increasing in the central and east-central equatorial Pacific, and decreasing in the western equatorial Pacific. The most recent analysis shows positive anomalies between the surface and 200m depth across most of the equatorial Pacific, particularly near the Date Line where sub-surface temperatures are up to 4°C above normal.



Low-level easterly wind anomalies have been observed across portions of the central and western equatorial Pacific since mid-December. As a response to the stronger-than-average easterly winds, SST anomalies have decreased in the region. Most statistical and coupled models estimate that El Niño conditions will weaken during the next 2-3 months, with a return of ENSO-neutral conditions sometime during the boreal spring (March - May 2007). With all these aforementioned factors in place, it seems likely that **weak-to-moderate El Niño conditions will continue through March-May.**

SOI (Southern Oscillation Index)

November marked the first month to have a positive SOI value since April 2006. During the second half of the year, the value of the SOI was -0.8, -1.6, -0.7, -1.7, +0.1 and -0.5 (for July through December, respectively). These persistently negative values of the SOI are consistent with El Niño in the Pacific basin, although their magnitudes are not that significantly large. Furthermore, the neutral-to-weak negative values of the SOI within the last 2 months are consistent with the weakening ENSO event.

Normally, positive values of the SOI in excess of +1.0 are associated with La Niña, and negative values of the SOI below -1.0 are associated with El Niño. The SOI is an index representing the normalized sea level pressure difference between Darwin, Australia and Tahiti, respectively.

**Figure 1.** 2006 Rainfall (a) totals in inches and (b) anomalies (expressed as percent of normal)

## TROPICAL CYCLONE

The PEAC archives western North Pacific tropical cyclone numbers, track coordinates, and 1-minute average maximum sustained wind taken from operational warnings issued by the Joint Typhoon Warning Center (JTWC) of the U. S. Air Force and Navy, located at Pearl Harbor, Hawaii. Western North Pacific tropical cyclone names are obtained from warnings issued by the Japanese Meteorology Agency (JMA), which is the World Meteorological Organization's Regional Specialized Meteorological Center (RSMC) for the western North Pacific basin. The PEAC archives South Pacific tropical cyclone names, track coordinates, central pressure, and 10-minute average maximum sustained wind estimates from advisories issued by the Tropical Cyclone Warning Centers at Brisbane, Nadi, and Wellington. The numbering scheme and the 1-minute average maximum sustained wind estimates are taken from warnings issued by the JTWC. There are sometimes differences in the statistics (e.g., storm maximum intensity) for a given tropical cyclone among the agencies that are noted in this summary.

## TROPICAL CYCLONE

2006 Tropical Activity Summary

The 2006 tropical cyclone season in the western North Pacific basin was overall below normal in most characteristics. There were fewer tropical storms (eight) than normal (ten), fewer typhoons (15) than normal (18), and the total number of all tropical cyclones (including depressions, tropical storms and typhoons) (27) was below normal (31). Two of the cyclones that were named by the JMA (Rumbia and Trami), were only classified as tropical depressions by the JTWC, and one of the cyclones (01W) was not named by the JMA but was classified as a tropical storm by the JTWC. The total number of super typhoons (those tropical cyclones with peak 1-minute sustained surface winds of 130 kt or more) was seven, which is three more than average. Some research indicates that there is a tendency for an above normal number of very intense typhoons during an El Niño year.

During 2006, the typhoon tracks were not typical of those commonly seen in an El Niño year. During El Niño there is usually a pronounced eastward shift in the genesis region of many of the tropical cyclones. The average "genesis location" (i.e. that latitude and longitude where a tropical cyclone first attains 25 kt on the JTWC best track) is near Guam. During El Niño, so many of the cyclones form to the east of normal, that the average "genesis location" is shifted well eastward from Guam. The most pronounced El Niño shift of tropical cyclone activity occurs in the region east of 160°E and south of 20°N. The ratio of cyclones in this region between El Niño years versus La Niña years is 15 to 1. In late 2006 (September through December), the tropical cyclone activity looked more like that seen in a La Niña year than during El Niño. Nearly all of the cyclones formed to the west of Guam, and many of them subsequently moved westward to adversely affect the Philippines. Four typhoons in succession, beginning with Cimaron (22W) in late October, then Chebi (23W) in early November, then Durian (24W) in late November, and ending with Utor (25W) in mid-December had devastating effects in the Philippine archipelago.

Hurricane Daniel was the first named storm in the central Pacific in 2006. Daniel formed 970 NM east-southeast of Hilo, Hawaii and dissipated well south of the Hawaiian islands. On August 20, Ioke began taking shape as a tropical depression (01C) far south of Hawaii. Three other cyclones (02C), (03C) and (04C) formed to the south-southwest of Hawaii during the 2006 season and dissipated without impacting any of the islands in the Central Pacific.

In Micronesia, only three of the year's tropical cyclones had noteworthy impacts: Ewiniar (04W), Ioke (01C), and Soulik (21W). On the first day of July, Ewiniar (while still a tropical storm) brushed past Yap Island bringing with it a damaging sea

## TROPICAL CYCLONE

inundation. Ioke (a powerful hurricane that originated to the south of Hawaii in late August and later moved into the western North Pacific basin – thus changing into a typhoon) passed almost directly over Wake Island causing substantial damage there. In early October, Soulik (in its early developmental stages) passed near Majuro and Kwajalein. High surf associated with this cyclone pushed water onto the runway at Majuro International Airport that led to a contamination of many millions of gallons of drinking water.

In mid-December, Tropical Cyclone 26W (named Tropical Storm Trami by the JMA) formed south of Guam, moved west-northwest, and then dissipated east of Luzon when it encountered a shear line. With the dissipation of this cyclone, the 2006 typhoon season in the western North Pacific came to an end.

PEAC Tropical Cyclone Outlook

While the western North Pacific is quieting down, the PEAC tropical cyclone outlook for the period February through April 2007 indicates increased threat of a damaging tropical cyclone passing near the islands of American Samoa. **Gale-force winds related to the close passage of a tropical cyclone or the penetration of a very active northwest monsoon into the region should occur at least once through the remainder of the hurricane season (April 2007), and could possibly occur up to 3 or 4 times.** (During January 2007, two cyclones, Zita and Arthur, formed in the South Pacific east of the International Date Line. No reports of damage were received from American Samoa in association with these two cyclones.) While a direct strike is not anticipated, the risk is higher than normal. **Thus, it is prudent for American Samoa to stay prepared for any developing low pressure systems.**

For the first half of 2007, tropical cyclone activity is anticipated to be below average in the western North Pacific. On average there are 5 numbered tropical cyclones in the western North Pacific from February through June. During El Niño there is typically more than this, and during non-El Niño years (particularly the years that follow El Niño) there are fewer than this. Based on the forecast of a slow demise of El Niño, the PEAC anticipates a relatively quiet first-half of 2007, with the risk of an early season typhoon reduced (but not eliminated) in Micronesia.

For Hawaii, the 2006 Hurricane Season ended quietly on November 30. Tropical storm activity is expected to remain below average for Hawaii and the Central Pacific through the first half of 2007.

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## LOCAL SUMMARY AND FORECAST



**American Samoa:** The 4th quarter of 2006 continued with wet conditions with above-normal rainfall totals of 47.47 inches (137% of normal) for Pago Pago International Airport and 63.74 inches (113% of normal) for Aasufou. December marked the wettest month in the quarter, with WSO Pago Pago receiving 21.63 inches (162% of normal) and Aasufou recording 27.56 inches of rain (142% of normal). — WSO Pago Pago

American Samoa Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
Pago Pago WSO	<b>Rain (Inches)</b>	9.75	16.07	21.63	<b>47.45</b>	<b>159.01</b>
	<b>% of Normal</b>	97%	144 %	162%	<b>137%</b>	<b>134%</b>
Aasufou	<b>Rain (Inches)</b>	16.64	19.54	27.56	<b>63.74</b>	<b>218.20</b>
	<b>% of Normal</b>	89%	108%	142%	<b>113%</b>	<b>113%</b>

**Climate Outlook:** American Samoa is now fully into its rainy season, although it has been very wet here for several months. Earlier computer forecasts (as well as the official PEAC forecasts) had indicated that rainfall in American Samoa was likely to remain above normal as the island group entered its rainy season. As weak to moderate ENSO conditions continue, American Samoa will continue to experience above-normal rainfall. At the time of this publication (late January), the Pago Pago Weather Service Office was already experiencing an above-normal rainfall for the month of January due to the establishment of the monsoonal trough extending southeasterly from Australia to the Southern Cooks. The forecast of wet conditions to continue through April 2007 in American Samoa is based on persistence, as well as the slow demise of a weak-to-moderate El Niño.

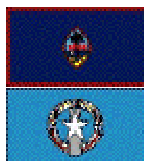
The threat of a damaging tropical cyclone in any of the islands of American Samoa remains high throughout the remainder of the Hurricane Season (until April 2007), thus it is prudent for American Samoa to stay prepared for any developing low pressure systems. Gale-force winds related to the close passage of a tropical cyclone or the penetration of a very active northwest monsoon into the region should occur at least once through April, and could possibly occur up to 3 or 4 times. During January 2007, two cyclones (Zita and Arthur) formed in the South Pacific east of the International Date Line. No reports of damage were received from American Samoa in association with these two cyclones.

Predicted rainfall for American Samoa from February 2007 through January 2008 is as follows:

Inclusive Period	% of long-term average
Feb - Apr 2007 (Heart of Next Rainy Season)	<b>140%</b>
May - Jun 2007 (Onset of Next Dry Season)	<b>120%</b>
Jul - Sep 2007 (Heart of Next Dry Season)	<b>100%</b>
Oct 2007 - Jan 2008 (Onset of Next Rainy Season)	<b>100%</b>

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## LOCAL SUMMARY AND FORECAST



**Guam/CNMI:** Annual rainfall totals on Guam were close to normal at most locations, with no reported occurrences of widespread damaging events of wind or rain. One noteworthy aspect of Guam's weather during 2006 was an extreme month-to-month variation of the rainfall during July through October. This behavior of the rainfall was likely the result of the Madden Julian Oscillation (MJO). The typical manifestation of the MJO in Micronesia is to produce several weeks of wet weather broken by a week or two of hot dry weather. During the last three months of 2006, the rainfall was generally a bit below normal at most Guam locations. The 4<sup>th</sup> quarter 2006 rainfall total of 24.56 inches at the WSO was 96% of normal (the combined result of a wet October followed by dry conditions in both November and December). By the time of the writing of this report (late January), persistent dryness since November of 2006 had begun to manifest itself in lowered stream flows and the onset of wildfires in the south. Strong trade winds and hazardous surf occurred almost daily for all of January 2007.

Guam and CNMI Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
<b>Guam</b>						
<b>GIA</b>	<b>Rain (Inches)</b>	15.39	5.20	3.97	<b>24.56</b>	<b>90.33</b>
	<b>% of Normal</b>	128 %	63%	74%	<b>96%</b>	<b>99%</b>
<b>AAFB</b>	<b>Rain (Inches)</b>	14.57	5.09	3.28	<b>22.94</b>	<b>76.79</b>
	<b>% of Normal</b>	113%	56%	55%	<b>82%</b>	<b>78%</b>
<b>Dededo (Ypapa)</b>	<b>Rain (Inches)</b>	17.17	6.56	5.97	<b>29.70</b>	<b>98.29</b>
	<b>% of Normal</b>	N/A*	N/A*	N/A*	<b>121%*</b>	<b>95%*</b>
<b>CNMI</b>						
<b>Saipan Intl. Airport</b>	<b>Rain (Inches)</b>	14.11	3.85	4.73	<b>22.69</b>	<b>65.82</b>
	<b>% of Normal</b>	131%	66%	123%	<b>111%</b>	<b>85%</b>
<b>Capitol Hill</b>	<b>Rain (Inches)</b>	10.00	4.36	3.71	<b>18.07</b>	<b>72.12</b>
	<b>% of Normal</b>	83%	60%	77%	<b>75%</b>	<b>85%</b>
<b>Tinian Airport</b>	<b>Rain (Inches)</b>	8.19	4.60	4.19	<b>16.98</b>	<b>56.84</b>
	<b>% of Normal</b>	68%	63%	87%	<b>70%</b>	<b>68%</b>
<b>Rota Airport</b>	<b>Rain (Inches)</b>	23.12	4.63	3.97	<b>31.72</b>	<b>83.03</b>
	<b>% of Normal</b>	182%	54%	70%	<b>118%</b>	<b>88%</b>

\* % of normal for Dededo is with respect to WSO Finigayan

\*\* % of normal are with respect to the WSO Tiyan (GIA)



## LOCAL SUMMARY AND FORECAST

The 2006 annual rainfall totals at stations in the CNMI were among the driest in all of Micronesia. The annual total of 56.84 inches at Tinian was the lowest annual total at any recording location in Micronesia, and it was also the lowest rainfall in terms of percent of normal (68%) throughout Micronesia during 2006. The 4<sup>th</sup> Quarter of 2006 was dry for all three months. On Rota, a very wet October helped to boost annual totals closer to normal than at other islands, and the 4<sup>th</sup> Quarter total of 31.72 inches was 118% of normal. Saipan was also drier than normal throughout most of 2006. The SIA 2006 annual total of 65.52 inches was 85% of normal. The 14.99 inches of rain at the SIA during October was the wettest monthly total for all of 2006. Only one other month (July) had over 10 inches, and six months had rainfall totals less than five inches!

**Climate Outlook:** Below normal rainfall is anticipated throughout all of Guam and the CNMI for the first six months of 2007. **Island residents are urged to participate in voluntary water conservation measures, and to undertake low-cost repairs and maintenance of the means of obtaining drinking water.** If extreme dry conditions develop in the next 3 to 6 months, a more serious effort may be required to ensure adequate water supplies for all islanders. The magnitude of the dry conditions expected for the next 6 months is not anticipated to be as extreme as the dry conditions experienced in the first 6 months of 1983, 1992, or 1998. **Most locations are expected to receive 60% to 70% of the rainfall normally expected during the first six months of 2007. However, month-to-month variations in rainfall patterns (which are unpredictable) may cause any location to experience less than half of normal rainfall during any one or two of the months from January through June of 2007.** The risk of wildfires will be high beginning in late January through June. Residents are urged to clear away brush and loose combustible materials located near their homes. During the record drought of the dry season of 1998, nearly 12% of Guam's land area was scorched by wildfires.

Predicted rainfall for the Mariana Islands from November 2006 through October 2007 is as follows:

Inclusive Period	% of long-term average	
	Guam/Rota	Saipan/Tinian
Feb – May 2007 (Heart of Dry Season)	60%	60%
Jun – Jul 2007 (Prolonged Dry Season)	70%	70%
Aug – Oct 2007 (Next Rainy Season)	95%	90%
Nov 2007 – Jan 2008 (Onset of Next Dry Season)	95%	90%

For more information on  
Guam's weather and climate go to  
[www.weather.gov/guam](http://www.weather.gov/guam)

## LOCAL SUMMARY AND FORECAST



## Federated States of Micronesia

**Yap State:** Rainfall throughout Yap State during 2006 was close to normal. The first half of 2006 was somewhat dry, but monthly rainfall in excess of 15 inches was experienced at many locations in during the 4<sup>th</sup> quarter. Much of the heavy rainfall in these months was from passing tropical disturbances and developing tropical cyclones, some of which went on to become devastating typhoons in the Philippines. Only one tropical cyclone adversely affected Yap during 2006. During the morning of the July 1, Tropical Storm Ewiniar (TC04W) passed approximately 40 miles to the southwest of Yap. This severe tropical storm caused a surprising amount of damage on Yap Island. A boat at mooring broke loose and damaged the official tide gage in Colonia. The highest waves during the storm came at high tide, causing substantial inundation that flooded coastal roads, damaged homes and contaminated a fresh-water catchment tank. Sea inundation levels were approximately half of those generated by Typhoon Sudal.

In an atypical pattern, Ulithi received a higher 2006 annual total of rainfall than at the Yap WSO, which, in turn, received more rainfall than Woleai. This appears to be an artifact of several developing tropical cyclones that passed to the north of Yap Island and produced heavy rainfall at Ulithi and on Yap Island, with lesser amounts recorded to the south. Most reporting sites

## Yap State Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
<b>Yap Proper</b>						
Yap WSO	Rain (Inches)	7.37	4.90	19.92	32.55	116.13
	% of Normal	60%	56%	213%	110%	88%
Dugor*	Rain (Inches)	10.53	4.27	22.20	37.00	123.97
Gilman*	Rain (Inches)	4.98	4.43	22.22	31.63	10.52
Luweech*	Rain (Inches)	7.73	4.97	19.63	32.33	120.20
Maap*	Rain (Inches)	9.72	4.61	15.99	30.32	117.83
North Fanif*	Rain (Inches)	8.11	4.43	20.93	33.47	118.91
Rumung*	Rain (Inches)	10.04	5.70	23.74	39.48	138.04
Tamil*	Rain (Inches)	8.53	4.78	15.52	28.83	116.84
<b>Outer Islands</b>						
Ulithi	Rain (Inches)	11.60	7.14	17.72	36.46	126.60
	% of Normal	114%	93%	232%	143%	124%
Woleai	Rain (Inches)	6.41	9.77	8.84	25.02	113.96
	% of Normal	47%	90%	77%	70%	82%

\* Long term normal is not established for these sites

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## LOCAL SUMMARY AND FORECAST

on Yap Island and on Ulithi received between 25 to 35 inches of rain during the 4<sup>th</sup> Quarter, and between 115 to 125 inches for the entire year.

**Climate Outlook:** Below normal rainfall is anticipated throughout all of Yap State for the first six months of 2007. **Island residents are urged to participate in voluntary water conservation measures, and to undertake low-cost repairs and maintenance of the means of obtaining drinking water.** If extreme dry conditions develop in the next 3 to 6 months, then a more serious effort may be required to ensure adequate water supplies for all islanders. The magnitude of the dry conditions expected for the next 6 months is not anticipated to be as extreme as the dry conditions experienced in the first 6 months of 1983, 1992, or 1998. **Most locations are expected to receive 60% to 70% of the rainfall normally expected during the first six months of 2007. However, month-to-month variations in rainfall patterns (which are unpredictable) may cause any location to experience less than half of normal rainfall during any one or two of the months from January through June of 2007.** As on Guam, Yap Island is prone to wildfires during very dry conditions, and residents may wish to clear away brush and combustible materials from areas they wish to protect from fire. At this time, the dry conditions are not expected to be as bad as those experienced during 1998.

Predicted rainfall for Yap State from February 2007 through January 2008 is as follows:

Inclusive Period	% of long-term average	
	Yap and Ulithi	Woleai
Feb – May 2007 (Heart of Next Dry Season)	70%	60%
Jun – Jul 2007 (Onset of Next Rainy Season)	85%	90%
Aug – Oct 2007 (Heart of Next Rainy Season)	100%	100%
Nov 2007 – Feb 2008 (Onset of Next Rainy Season)	100%	100%

**Chuuk State:** Rainfall throughout Chuuk State during 2006 was near normal, with annual totals throughout the state mostly within the range of 120 to 150 inches. Rainfall at Polowat was considerably drier than at the WSO, and the 2006 annual total there of 97.39 inches was the lowest annual total recorded in Chuuk State. Substantial month-to-month rainfall variations associated with the MJO were observed on some of the islands of Chuuk State during 2006. For example, the September totals were less than 10 inches on some Islands following August totals that were close to 20 inches. Otherwise, 2006 was rather uneventful.

**Climate Outlook:** The anticipated onset of widespread El Niño-related dry conditions during November and December did not occur, and rainfall in the 4<sup>th</sup> Quarter of 2006 was near normal. This is important, since dry conditions are still likely to occur throughout Chuuk State for the next 3 to 4 months. **Rainfall in Chuuk State typically is below normal through March or April of the year following El Niño. Residents of Chuuk State are urged to participate in voluntary water conservation measures, and make all reasonable repairs and routine maintenance to rain catchments and other drinking water**

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## LOCAL SUMMARY AND FORECAST

## Chuuk State Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
<b>Chuuk Lagoon</b>						
<b>Chuuk WSO</b>	<b>Rain (Inches)</b>	9.00	14.06	12.40	<b>35.46</b>	<b>143.09</b>
	<b>% of Normal</b>	67%	136%	114%	<b>103%</b>	<b>107%</b>
<b>Piis Panew*</b>	<b>Rain (Inches)</b>	8.01	8.43	3.78	<b>20.22</b>	<b>91.35</b>
<b>Xavier H. School*</b>	<b>Rain (Inches)</b>	10.24	12.58	11.75	<b>34.57</b>	<b>140.62</b>
<b>Southern Mortlocks</b>						
<b>Lu-kunoch*</b>	<b>Rain (Inches)</b>	10.35	12.32	8.65	<b>32.32</b>	<b>133.34</b>
<b>Ettal*</b>	<b>Rain (Inches)</b>	7.88	8.54	7.04	<b>23.46</b>	<b>121.95</b>
<b>Ta*</b>	<b>Rain (Inches)</b>	5.93	8.79	5.74	<b>20.46</b>	<b>120.65</b>
<b>Northern Atolls</b>						
<b>Fananu*</b>	<b>Rain (Inches)</b>	11.98	7.80	12.37	<b>32.15</b>	<b>118.83</b>
<b>Onoun*</b>	<b>Rain (Inches)</b>	11.36	14.07	11.44	<b>36.87</b>	<b>120.57</b>
<b>Northern Mortlocks</b>						
<b>Losap*</b>	<b>Rain (Inches)</b>	10.53	9.90	12.54	<b>32.97</b>	<b>137.72</b>
<b>Nama*</b>	<b>Rain (Inches)</b>	11.43	11.66	13.04	<b>36.13</b>	<b>152.87</b>
<b>Western Atolls</b>						
<b>Polowat</b>	<b>Rain (Inches)</b>	5.65	9.31	3.72	<b>18.68</b>	<b>97.39</b>
	<b>% of Normal</b>	N/A	N/A	N/A	<b>53%</b>	<b>68%</b>

\* Long term normal is not established for these sites

\*\* Estimated

**infrastructure. At this time, the dry conditions are not expected to be as bad as those experienced during 1998.** Rainfall amounts should recover to near normal by May or June of 2007.

Predicted rainfall for Chuuk State from February 2007 through January 2008 is as follows:

Inclusive Period	% of long-term average			
	Chuuk Lagoon Losap and Nama	Polowat	Northern Islands	Mortlocks
Feb - Apr 2007	70%	70%	70%	70%
May - Jul 2007	90%	85%	85%	90%
Aug - Oct 2007	95%	95%	95%	100%
Nov 2007 - Jan 2008	100%	100%	100%	100%

## LOCAL SUMMARY AND FORECAST

**Pohnpei State:** Rainfall throughout Pohnpei State during 2006 was near normal, except at Kapingamarangi where the rainfall has been well above normal for many months. The 2006 annual total of 160.26 inches at Kapingamarangi was 146% of its normal annual rainfall, and this was the highest departure from normal of any rainfall observation throughout Micronesia in 2006 (**Fig. 1b**). The persistent warmer than normal SST that surrounds Kapingamarangi, extending eastward past the International Date Line, may be responsible for the prolonged period of excessive rain there. Pohnpei State also captured another top observation during 2006: the 2006 annual total of 210.02 inches of rainfall at Palikir was the highest observed annual total throughout Micronesia. Though high, this amount of rainfall was just slightly above the estimated annual normal of 204 inches at Palikir. Rain gages placed on top of Nahnaud had 3 months of missing data during 2006, but extrapolation of the annual amount with estimated values used for the missing monthly values indicates rainfall in excess of 300 inches there during 2006!

**Climate Outlook:** Dry conditions related to the El Niño that began in mid-2006 should not affect Pohnpei too harshly. **Any island within Pohnpei State may experience a month or two of abnormally dry weather at any time during the period February through April 2007, after which rainfall amounts**

## Pohnpei State Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
<b>Pohnpei Island</b>						
<b>Pohnpei WSO</b>	<b>Rain (Inches)</b>	13.79	18.77	13.09	<b>45.65</b>	<b>172.32</b>
	<b>% of Normal</b>	83%	119%	86%	<b>96%</b>	<b>91%</b>
<b>Palikir</b>	<b>Rain (Inches)</b>	15.18	22.17	11.15	<b>48.50</b>	<b>210.02</b>
	<b>% of Normal</b>	N/A	N/A	N/A	<b>94%</b>	<b>103%</b>
<b>Nahna Laud*</b>	<b>Rain (Inches)</b>	20.22	N/A	N/A	N/A	<b>310**</b>
<b>Atolls of Pohnpei State</b>						
<b>Nukuoro</b>	<b>Rain (Inches)</b>	9.45	8.47	14.20	<b>32.12</b>	<b>179.95</b>
	<b>% of Normal</b>	88%	71%	118%	<b>92%</b>	<b>120%</b>
<b>Pingelap</b>	<b>Rain (Inches)</b>	18.00	8.80	14.23	<b>41.03</b>	<b>150.72</b>
	<b>% of Normal</b>	122%	62%	106%	<b>97%</b>	<b>85%</b>
<b>Mwoa-killoa*</b>	<b>Rain (Inches)</b>	14.99	14.21	11.40	<b>40.60</b>	<b>141.16</b>
<b>Kapingamarangi</b>	<b>Rain (Inches)</b>	13.37	8.56	13.50	<b>35.43</b>	<b>160.26</b>
	<b>% of Normal</b>	N/A	N/A	N/A	<b>165%</b>	<b>146%</b>

\* Long term normal is not established for these sites

\*\* Estimated

## LOCAL SUMMARY AND FORECAST

**should return to near normal. As a precaution, residents of Pohnpei State are urged to participate in voluntary water conservation measures, and should make all reasonable repairs and routine maintenance to rain catchments and other drinking water infrastructure.** At this time, the dry conditions are not expected to be as bad as those experienced during 1998. So long as the SST remains above normal in the equatorial region near the International Date Line, the rainfall at Kapingamarangi should not drop below normal.

Predicted rainfall for Pohnpei State from November 2006 through October 2007 is as follows:

Inclusive Period	% of long-term average	
	Pohnpei Island and atolls	Kapingamarangi
Feb - Apr 2007	<b>70%</b>	<b>90%</b>
May - Jun 2007	<b>90%</b>	<b>100%</b>
Jul - Oct 2007	<b>95%</b>	<b>100%</b>
Nov 2007 - Jan 2008	<b>100%</b>	<b>95%</b>

**Kosrae State:** Rainfall averaged close to normal on Kosrae during 2006, although some sharp month-to-month differences were experienced (possibly related to MJO). At the SAWRS observing site at the airport, there were four months with over 24 inches of rain and two months with less than 10 inches. The 12-month sum of these monthly totals was just shy of normal at Kosrae SAWRS, where the 2006 annual total of 199.94 inches was 97% of the normal value of 206.17 inches. Annual totals at other locations around Kosrae were close to the values at the SAWRS observing site at the airport on the north side of the island. The 2006 annual total was 199.27 inches at Utwa (south side) and 188.72 inches at the Nautilus Hotel (east side).

**Climate Outlook:** Dry conditions related to the El Niño that began in the 2<sup>nd</sup> half of 2006, should not affect Kosrae too harshly. **Kosrae may experience a month or two of abnormally dry weather (less than 10 inches per month) at any time during the period February through May 2007, after which rainfall amounts should be near normal (typically over 15 inches per month).** As a precaution, residents of Kosrae State should make all reasonable repairs and routine maintenance to rain catchments and other drinking water infrastructure. At this time, the dry conditions are not expected to be as bad as those experienced during 1998.

## Kosrae State Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
<b>Airport (SAWRS)</b>	<b>Rain (Inches)</b>	14.72	9.99	18.30	<b>43.01</b>	<b>199.94</b>
	<b>% of Normal</b>	91%	63%	126%	<b>92%</b>	<b>97%</b>
<b>Utwa*</b>	<b>Rain (Inches)</b>	18.68	12.44	16.96	<b>48.08</b>	<b>199.27</b>
<b>Nautilus*</b>	<b>Rain (Inches)</b>	19.28	12.85	15.96	<b>48.09</b>	<b>188.72</b>

\* Long term normal is not established for these sites

## LOCAL SUMMARY AND FORECAST

Predicted rainfall for Kosrae State from February 2007 through January 2008 is as follows:

Inclusive Period	% of long-term average
Feb – Apr 2007	<b>70%</b>
May – Jul 2007	<b>95%</b>
Aug – Oct 2007	<b>100%</b>
Nov 2007 – Jan 2008	<b>100%</b>



**Republic of Palau:** The rainfall throughout most of Palau during 2006 was near normal. The 2006 annual totals at the WSO and at Nekken were almost identical (157.02 versus 157.44 inches), whereas at the Palau International Airport (only a short distance from between two locations), there was considerably more rainfall (180.35 inches). Almost 13 inches of this difference occurred in the months of January, June and July when the airport had 4 to 5 inches more in each of these months than at Koror or Nekken. Peleliu was the driest reporting location in the Republic of Palau with its 2006 annual total of 120.38 inches. It was drier at Peleliu than at Koror for 10 out of the 12 months of the year. Though a long-term mean has not been officially established for Peleliu, it appears from recent year's data that the rainfall there is roughly 80 to 90% of the rainfall at Koror.

## Republic of Palau Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
<b>Koror WSO</b>	<b>Rain (Inches)</b>	10.73	5.41	10.97	<b>27.11</b>	<b>157.02</b>
	<b>% of Normal</b>	80%	47%	89%	<b>72%</b>	<b>106%</b>
<b>Nekken*</b>	<b>Rain (Inches)</b>	11.10	9.64	11.96	<b>32.70</b>	<b>157.44</b>
<b>Intl. Airport*</b>	<b>Rain (Inches)</b>	10.52	8.79	13.07	<b>32.38</b>	<b>180.35</b>
<b>Peleliu*</b>	<b>Rain (Inches)</b>	8.12	6.54	8.92	<b>23.58</b>	<b>120.38</b>

\* Long term normal is not established for these sites

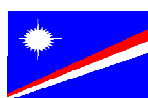
**Climate Outlook:** Dry conditions related to the El Niño should not affect the Republic of Palau too harshly, since much of the dryness at Palau often occurs in the 4<sup>th</sup> Quarter of the El Niño year as evidenced by October and November rainfall deficits. **Any island within the Republic of Palau may experience a month or two of abnormally dry weather at any time during the period February through April 2007, after which rainfall amounts should return to near normal. Residents of Palau are urged to participate in voluntary water conservation measures, and should make all reasonable repairs and routine maintenance to rain catchments and other drinking water infrastructure.** At this time, the dry conditions are not expected to be anywhere near as bad as those in 1998. Palau has a complex pattern of monthly rainfall with the highest average rainfall in the months of June and July; the lowest average rainfall in the months of February, March and April; and a secondary minimum in September. The average rainfall in Palau in

## LOCAL SUMMARY AND FORECAST

each of the months February through April is less than 10 inches, and then jumps to nearly 12 in May, and to over 17 inches in June. The possible effects of El Niño on the rainfall in Palau over the next several months may be to cut the totals in February through April to roughly 6 to 8 inches per month, then slightly delay the normal return of heavier rains in May. The normal June and July seasonal peak of rainfall should arrive on schedule.

Predicted rainfall for Palau from February 2007 through January 2008 is as follows:

Inclusive Period	% of long-term average
Feb – Apr 2007	<b>75%</b>
May – Jul 2007	<b>90%</b>
Aug – Oct 2007	<b>100%</b>
Nov 2007 – Jan 2008	<b>100%</b>

**Republic of the Marshall Islands (RMI):**

The rainfall throughout the RMI during 2006 was near normal at some locations and a bit below normal at others. The 2006 annual total at WSO Majuro was 104.63 inches, or 80% of its normal. At Laura, on the southwest end of the atoll, the 2006 rainfall total was less (88.37 inches). The annual distribution of rainfall at Kwajalein closely tracked its normal pattern, and the annual total of 103.61 inches was 101% of normal. Some hint of dryness (possibly related to El Niño) was noted in the 4<sup>th</sup> Quarter totals at most islands. The 26.45 inches at the WSO Majuro during the 4<sup>th</sup> Quarter of 2006 was only 69% of normal. Ironically, Kwajalein's 39.49 inches (129%) in the 4<sup>th</sup> Quarter was the highest reported throughout the RMI.

## RMI Rainfall Summary 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
<b>RMI Central and Southern Atolls</b>						
<b>Majuro WSO</b>	<b>Rain (Inches)</b>	10.75	8.05	7.65	<b>26.45</b>	<b>104.63</b>
	<b>% of Normal</b>	77%	68%	67%	<b>71%</b>	<b>80%</b>
<b>Laura</b>	<b>Rain (Inches)</b>	4.30	9.58	12.52	<b>26.10</b>	<b>88.37</b>
<b>Aling-laplap</b>	<b>Rain (Inches)</b>	5.93	11.97	9.26	<b>27.16</b>	<b>114.97</b>
<b>Mili</b>	<b>Rain (Inches)</b>	13.41	12.85	7.78	<b>34.04</b>	<b>141.16</b>
<b>RMI Northern Atolls</b>						
<b>Kwajalein</b>	<b>Rain (Inches)</b>	19.91	13.01	6.57	<b>39.49</b>	<b>103.62</b>
	<b>% of Normal</b>	174%	121%	83%	<b>126%</b>	<b>105%</b>
<b>Arno</b>	<b>Rain (Inches)</b>	12.34	9.01	7.81	<b>29.16</b>	<b>100.95</b>
<b>Wotje*</b>	<b>Rain (Inches)</b>	9.59	7.91	9.02	<b>26.52</b>	<b>78.38</b>



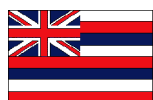
## LOCAL SUMMARY AND FORECAST

El Niño-related tropical cyclone activity that was anticipated in the Marshalls during the final months of 2006 into January 2007 did not occur. Only one tropical cyclone was a problem: in early October, the tropical disturbance that became Typhoon Soulik (TC 21W) tracked close to Majuro and Kwajalein. Gusty southerly winds associated with this tropical system produced high seas that topped the seawall on the southern boundary of the Majuro Airport. Saltwater contaminated 8 million gallons of fresh water. Some of the cloud systems in the Central Pacific looked as if they could become tropical cyclones that would affect the Marshall Islands, but no significant cyclone moved across the region. Paka (1997) was the last tropical cyclone of typhoon intensity to pass through the Marshall Islands. Ioke (early September 2006) was a potent threat and did significant damage to Wake Island.

**Climate Outlook:** During El Niño, the rainfall pattern in the RMI is very complex. Usually the northern islands of the RMI enter a prolonged dry spell for the first several months in the year that follows the El Niño year. The central RMI (this includes Majuro) often are quite dry and the southern RMI and the islands of Kiribati can be wetter. **Any atoll in the northern RMI may experience a month or two of abnormally dry weather at any time during the period February through May 2007, after which rainfall amounts should return to near normal. All residents of RMI are urged to participate in voluntary water conservation measures, and should make all reasonable repairs and routine maintenance to rain catchments and other drinking water infrastructure.** At this time, the dry conditions are not expected to be as bad as those in 1998. The islands in the northern RMI are usually quite dry during the first three months of the year anyway, with less than 5 inches per month experienced at Kwajalein (and other northern atolls) in each of January, February, and March. By May, the monthly rainfall rises to near 10 inches, and is over 10 inches per month from July through November. Wotje and Utirik are normally a little drier. The possible effects of El Niño on the rainfall in the northern RMI over the next several months may be to cut the totals in February through April to roughly 2 to 4 inches per month, then slightly delay the normal return of heavier rains in May, and possibly into June. By July the rainfall will recover to near normal.

Predicted rainfall for the RMI from February 2007 through January 2008 is as follows:

Inclusive Period	% of long-term average		
	South of 6°N	6°N to 8°N	North of 8°N
Feb – Apr 2007	90%	80%	70%
May – Jun 2007	90%	90%	80%
Jul – Oct 2007	100%	100%	100%
Nov 2007 – Jan 2008	100%	100%	95%



**Hawaii:** According to the National Weather Service's Standardized Precipitation Index (SPI), 4th quarter rainfall was near average across most of the state, while portions of Hawaii, Lanai and Kauai experienced moderately dry conditions. Windward and Upcountry Maui experienced moderately wet conditions for the 3-month period.

## LOCAL SUMMARY AND FORECAST

The first half of the 2006-2007 Hawaiian wet season (October through April) started strong and produced several heavy rain and flash flood events across the state, with heavy rains causing road and highway closures on the Big Island and Maui between October 16-20. The beginning of November was marked by heavy rains along the east-facing slopes of Kauai, Maui, and Oahu. Saturated grounds along the Koolau Range of Oahu helped trigger a large landslide on November 1 which closed the Pali Highway Tunnel (linking windward and leeward Oahu) for most of the day. On November 2, flash flooding closed several central valley roads and nearly swept a young Maui boy out to sea near Peahi between Haiku and Pauwela. Heavy showers over portions of north and central Maui resulted in flash flooding, road closures, and some property damage at Maui County's Baldwin Park between Dec 1-3. The rains also triggered a mudslide on the Haleakala Highway between the Hana Highway and Haliimaile Road. Following the heavy rains, trade winds persisted through December 23 with trade strength increasing to strong levels on December 8 and 15. The December 8 wind episode knocked down some trees and damaged a few roofs and utility poles in Honolulu.

Additional individual rainfall station information and specific island information for Hawaii can be found in the Monthly Precipitation Summaries which are located online at

## State of Hawaii Rainfall Summary, 4th Qtr 2006

Station		Oct.	Nov.	Dec.	4th Qtr	2006 Total
Lihue Airport	Rain (Inches)	3.71	2.98	0.59	7.28	66.48
	% of Normal	87%	63%	12%	54%	171%
Honolulu Airport	Rain (Inches)	2.50	2.61	0.58	1.89	29.61
	% of Normal	115%	115%	20%	83%	140%
Kahului Airport	Rain (Inches)	4.16	3.04	3.25	10.45	18.61
	% of Normal	396%	140%	106%	214%	96%
Hilo Airport	Rain (Inches)	7.42	3.21	6.66	17.29	113.18
	% of Normal	77%	21%	63%	54%	94%

<http://www.prh.noaa.gov/hnl/pages/hydrology.php> .

**Climate Outlook:** According to the Climate Prediction Center's official 90 day outlook for Hawaii, dynamic and statistical models indicate a tendency toward below normal temperature for Hawaii from JFM (January-February-March) to FMA (February-March-April) 2007. **The models indicate a tendency towards below normal precipitation from JFM (January-February-March) to FMA (February-March-April) 2007.** Short term global climate fluctuations such as the ENSO (El Niño - Southern Oscillation) phenomenon are found to play an important role in the climate variability in Hawaii. **During the late winter and spring of ENSO events, drier-than-average conditions can be expected in Hawaii.**

## Seasonal Sea Level Outlook for the US-Affiliated Pacific Islands

The following sections describe: (i) the CCA-based forecasts for sea level deviations for the forthcoming season, (ii) tide predictions (January 01 - March 31), and (iii) the observed/forecast monthly sea-level deviations for the previous season OND 2006. All units are in inches. Note that deviations are defined here as the difference between the mean sea level for the given month and the 1975 through 1995 mean sea level value computed at each station. Also, note that the forecasting technique adapted here does not account for sea level deviations created by other atmospheric or geological conditions such as tropical cyclones, storm surges or tsunamis.

## (i) Seasonal Sea Level Forecast (deviations with respect to climatology) for JFM, FMA, and MAM 2007

Forecasts of the sea level anomalies in the USAPI are presented using CCA statistical model. Based on the independent SST values in OND 2006, the resulting CCA model was used to forecast the sea level of three consecutive month periods: Jan-Feb-Mar (JFM), Feb-Mar-Apr (FMA), and Mar-Apr-May (MAM) (Table 1).

Table 1: Forecasts of sea level deviation (in inches) for JFM, FMA, and MAM 2007

Tide Gauge	JFM	FMA	MAM	Forecast Quality <sup>1</sup>
Lead time <sup>2</sup>	0	1M	2M	
Guam	-3	**	+2	Strong
Malakal	-6	-3	**	Good
Yap	-5	-2	-2	Strong
Pohnpei	**	+2	+3	V.Strong
Kapinga-marangi	**	**	**	Strong
Majuro	**	+2	+3	Good
Kwajalein	**	**	+3	Strong
Pago Pago	**	**2	-2	V.Strong

1. Forecast quality is a measure of the expected CCA cross-validation correlation skill. These forecasts are generally thought to be of useful skill (or at least fair skill) if the CCA cross-validation value is greater than 0.3. Higher skills correspond to a greater expected accuracy of the forecasts. Skill levels greater than 0.4 and 0.5 are thought to be moderate and good, respectively, while skill levels greater than 0.6 and 0.8 are thought to be strong and very strong, respectively.

For CCA cross-validation skill in JFM, FMA and MAM, please refer to: [http://www.soest.hawaii.edu/MET/Enso/peu/2007\\_1st/Sea\\_Level.htm](http://www.soest.hawaii.edu/MET/Enso/peu/2007_1st/Sea_Level.htm).

2. Lead time is the time interval between the end of the initial period and the beginning of the forecast period. For example, lead-0, lead-1M, and lead-2M means 'sea-level' of target season 0 (JFM), 1 (FMA), and 2 (MAM) month leads based on SSTs of OND.

**Note:** (-) indicates negative deviations (fall of sea level from the mean), and (+) indicates positive deviations (rise of sea level from the mean), N/A: data not available. Deviations of +/-1 in. are considered negligible and denoted by \*\*. Deviations +/- 2 in. are unlikely to cause any adverse climatic impact.

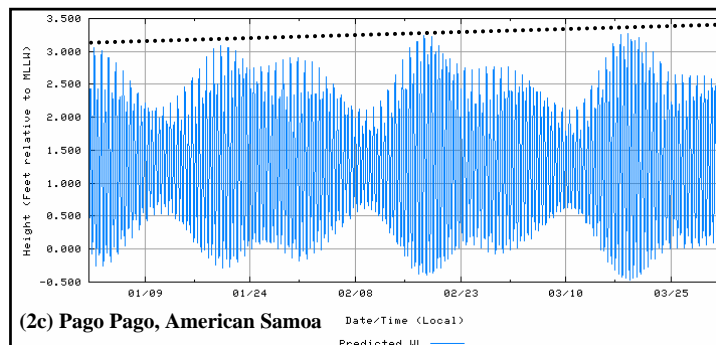
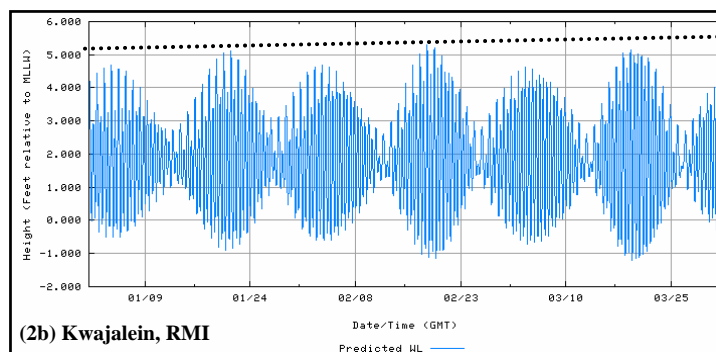
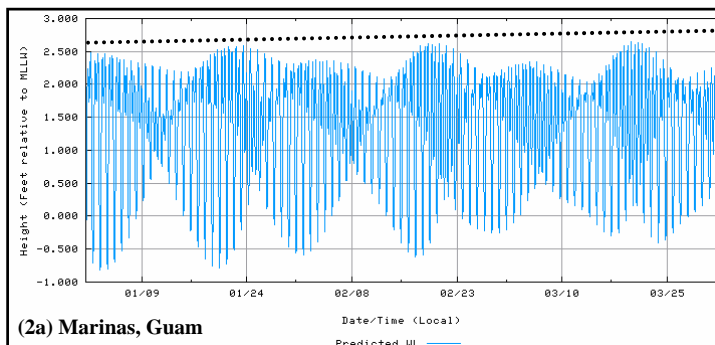
With a mean skill greater than 0.65 (at 0 to 2-months lead time) in all the three consecutive seasons (JFM, FMA, and MAM), all the tide gauge stations are well predicted. However, the forecasts skill for JFM has been found to be slightly lower than the previous season (OND).

The forecast values of sea-level for JFM, FMA, and MAM (Table 1), which also determines fall in most of the north Pacific islands, is consistent with the present on-going weak El Niño conditions in the tropical Pacific. **Note that, according to CPC, El Niño conditions are likely to continue through March-May 2007.**

## (ii) Tide Predictions (January 01 to March 31)

**Figure 2,** Below and Right: Predicted water level plot from January 01-March 31, 2007 for 3 major stations (a) Marinas, Guam (b) Kwajalein, RMI and (c) Pago-Pago, American Samoa. Dotted line in each graph represents monthly mean water level.

NOAA's web site for tide and currents has been used to generate this water level plot for the next three months. Other tide-related monthly extreme data can be found in the web edition of this newsletter. When compared to other major El Nino years, the overall tide data in all these stations are found to record a moderate fall. *With the exception of Samoa, the long term sea-level time series data of Guam, Palau, CNMI, Marshalls, and FSM are significantly correlated to each other. So, other stations are likely to experience similar fluctuations.*



## EXPERIMENTAL SEA LEVEL FORECASTS

## (iii) Observed monthly sea level deviation in Oct-Nov-Dec (OND), 2006

The monthly time series (January to March) for sea level deviations have been taken from the UH Sea Level Center. The full time series (in mm) is available at <ftp://ilikai.soest.hawaii.edu/islp/slpp/deviations>. Deviations are defined here as the difference between the mean sea level for the given month and the 1975 - 1995 mean sea level value computed at each station. See **Figure 3** (right) for location of these stations.

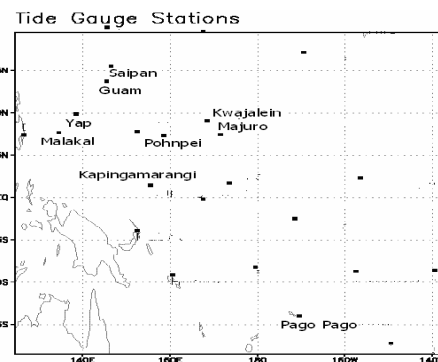
**Table 2** provides the monthly observed sea level deviations (in inches). Like the 3<sup>rd</sup> quarter (JAS) of 2006, the 4<sup>th</sup> quarter (OND) also displayed moderate to weak positive deviations in most of the tide gauge stations in USAPI (**Table 2**). Only Majuro at Marshalls and Pohnpei at FSM recorded some marginal negative deviations during this time. The sea-level variation in the northwestern tropical Pacific islands has been identified to be sensitive to the ENSO-cycle, with low sea-levels during El Niño and high sea-levels during La Niña events. Despite the mature El Niño conditions, however, the sea level has not yet recorded any considerable fall this year. This could be due to the evaluation pattern of this year's El Niño, the onset of which is relatively late (September 2006). Therefore, considerable sea level drop is yet to be seen—and will most likely be visible in the months to come.

As per CCA model forecasts, a slight fall of sea level was predicted in OND, NDJ, and DJF in the vicinity of western North Pacific (Guam, Malakal, Yap, and Pohnpei) while the other tide gauge stations in the central and southern part of the Pacific were predicted to be near normal (**Figure 4**). Real-time observed data provided slight variations here - most of the western north Pacific stations recorded several inches rise. This finding is not very consistent with the on-going El Niño event (August-December 2006), in which case the sea levels are likely to show a considerable fall.

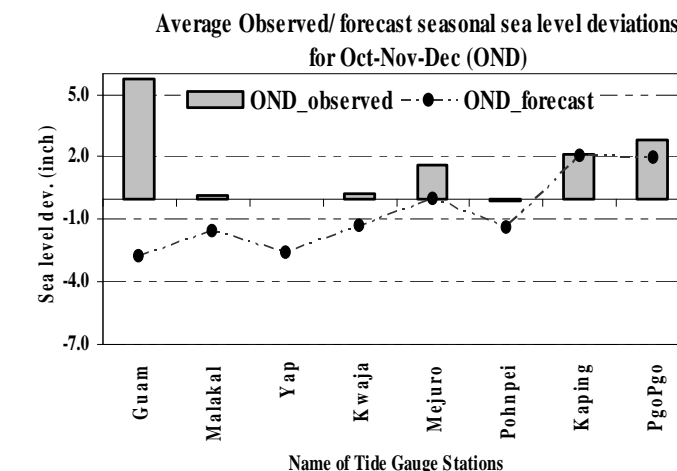
**Table 2 : Monthly observed sea level deviations in inches (year to year standard deviation in parentheses)**

Tide Gauge Station	Oct.	Nov.	Dec.	Average observed/forecast seasonal sea-level deviations
Marianas, Guam	n/a (3.5)	+5.4 (3.8)	+6.1 (4.4)	<p>Average Observed/ forecast seasonal sea level deviations for Oct-Nov-Dec (OND)</p>
Malakal, Palau	+1.8 (4.0)	+0.7 (4.0)	-2.0 (4.0)	
Yap, FSM	n/a (4.5)	n/a (4.0)	n/a (4.6)	
Kwajalein, Marshalls	+5.6 (3.0)	+5.0 (3.1)	+4.0 (3.4)	
Majuro, Marshalls	+3.3 (3.2)	-0.1 (3.8)	0 (4.2)	
Pohnpei, FSM	-0.5 (4.4)	+0.2 (4.5)	0 (5.0)	
Kapingamarangi, FSM	+2.9 (2.8)	+2.2 (3.1)	+1.2 (3.2)	
Pago Pago, A Samoa	+3.9 (2.4)	+1.9 (2.1)	+2.6 (1.9)	

**Note:** - indicate negative deviations (fall of sea-level from the mean), and + indicate positive deviations (rise of sea-level from the mean), n/a: data not available, and figures in parenthesis are year-to-year SD (standard deviations) for the month.



**Figure 3:** Location of Tide Gauge Stations



**Figure 4:** Average Observed/ forecast seasonal sea level deviations for Oct-Nov-Dec (OND)

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# Pacific ENSO Update

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## ENSO FORECAST

### Excerpt from PROGNOSTIC DISCUSSION FOR LONG-LEAD OUTLOOKS

NOAA-NWS-Climate Prediction Center-Camp Springs, MD—8:30 EDT Thursday January 18, 2007

Equatorial sea surface temperatures in the Pacific Ocean remained above their long-term average from just off the South American coast to about 165°E, with departures of more than 1°C above average observed between 165°E and 175° E and between 145°W and 85°W. . However, these departures are generally smaller than those observed last month... as the current El Niño has weakened. Most prediction tools indicate that SST anomalies in the NINO 3.4 region will decrease during the next few months... Thus, weak or possibly moderate El Niño conditions are anticipated for the next few months. Therefore this event has the potential to impact the climate of the United States for the next few months.

## EL NINO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

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[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/enso\\_advisory/](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/)

**Synopsis:** *El Niño conditions are likely to continue through march-May 2007.*

Equatorial Pacific SST anomalies greater than +1°C were observed in most of the equatorial Pacific between 170°E and the South American coast. The latest SST departures in the Niño regions are around +1.0°C, except near +0.5°C for Niño 1+2. The increase in SST anomalies during the last half of 2006 was accompanied by weaker-than-average low-level equatorial easterly winds across most of the equatorial Pacific and negative values of the Southern Oscillation Index (SOI). Collectively, these oceanic and atmospheric anomalies indicated the development of El Niño in the tropical Pacific.

Most of the statistical and dynamical models, including the NCEP Climate Forecast System (CFS), indicate that SST anomalies are near their peak and that decreasing anomalies are likely during February-May 2007. Recent observed trends in the upper ocean tend to support those forecasts. Decreasing upper-ocean heat content in the central equatorial Pacific has been progressing east in association with the upwelling portion of the most recent Kelvin wave. In the absence of any further Kelvin wave activity, the upper-ocean heat content should return to near average in a few months.

... Global effects that can be expected during January-March include drier-than-average conditions over portions of Malaysia, Indonesia, northern and eastern Australia, some of the U.S.-affiliated islands in the tropical North Pacific...

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The Pacific ENSO Update is a bulletin of the Pacific El Niño-Southern Oscillation (ENSO) Applications Center (PEAC). PEAC conducts research & produces information products on climate variability related to the ENSO climate cycle in the U.S.-affiliated Pacific Islands (USAPI). This bulletin is intended to supply information for the benefit of those involved in such climate-sensitive sectors as civil defense, resource management, and developmental planning in the various jurisdictions of the USAPI.

The Pacific ENSO Update is produced quarterly both online and in hard copy, with additional special reports on important changes in ENSO conditions as needed. For more information about this issue please contact the editor, LT(jg) Sarah Jones, at [peac@noaa.gov](mailto:peac@noaa.gov) or at the address listed below.

PEAC is part of the Weather Forecast Office (WFO) Honolulu's mission and roles/responsibilities. All oversight and direction for PEAC is provided by the Weather Forecast Office Honolulu in collaboration with the Joint Institute for Marine and Atmospheric Research (JIMAR) at the University of Hawaii. Publication of the Pacific ENSO Update is supported by the National Oceanic and Atmospheric Administration (NOAA), National Weather Service-Pacific Region Climate Services. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA, any of its sub-agencies, or cooperating organizations.

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